Introduction

Since its inception in 1960, the Marshall Space Flight Center in Huntsville, Alabama has been at the center of the American space program. The Center built the rockets that powered Americans to the Moon, developed the propulsion system for Space Shuttle, and managed the development of *Skylab*, the Hubble Space Telescope, and Spacelab. It is one of NASA's most diversified field Centers, with expertise in propulsion, spacecraft engineering, and human systems and multitudinous space sciences.

Yet the Center's role in American space exploration has often been obscure. Americans following the major space flights of the Mercury, Gemini, and Apollo Programs in the 1960s, *Skylab* in the 1970s, and the Shuttle in the 1980s focused most of their attention on the launch site in Florida or mission control in Houston. Popular histories of the space program accentuate astronauts. When accounts of the early space program do examine Marshall's role, they tend to highlight the dominating presence of Wernher von Braun, the Center's first director, rather than the institution itself. The Center's achievements have often been behind-the-scenes, and if they have not always captured public attention, they have frequently been at the center of NASA's triumphs.

The present work explores Marshall's evolution at the center of NASA, from its origins as an Army missile development organization through its participation in major American space programs. We have employed a generally chronological approach, exploring in topical chapters Marshall's contributions to NASA's major programs. In each chapter, we have traced the Center's contributions to the program and the ways in which the Center's participation shaped the institution itself.

Our own inclinations and the scope and requirements of the NASA contract under which we wrote this book have led us to examine Marshall's history

differently from previous treatments. Most previous studies of Marshall's contributions to the space program have been products of what British aerospace scholar Rip Bulkeley called the "Huntsville school" of American space historians,[1] a group that included von Braun himself and several of his associates, most prominently Frederick I. Ordway. Works of this school have chronicled the technical achievements of early space projects in Huntsville, focusing on the role of von Braun and his German team. The Huntsville school took a narrow approach and minimized the social and political context of technological history. The most significant work on Marshall's contributions that is not a product of the Huntsville school is Roger Bilstein's *Stages to Saturn* 1980, a detailed technological history of the Saturn family of launch vehicles.

Technological achievements are the heart of the Marshall story. The Center's accomplishments in engineering and technology have not only contributed to most of NASA's major efforts in human space flight, but have included an array of automated spacecraft that have made breakthroughs in space science, and provided platforms for researchers from other Centers, universities, and private industry.

Nonetheless, the story of the Center cannot be understood apart from its social and political context. Often the Center and its technical efforts developed as much because of political pressures—both from within NASA and from the outside—as because of the technological imperatives of space exploration. The NASA contract under which we worked in fact mandated that we explore Marshall's contributions toward, and responses to, changes in its social, political, and technological environment. While research was underway, several Marshall veterans reviewing our manuscript questioned the social and political approach even to the point that the Center canceled the contract under which we were working. Ultimately, however, NASA and the Center confirmed an approach to MSFC's history that extended beyond technology and reinstated the original contract and its research design.

A broad approach to the Center's history is necessary because Marshall has always been complex, even enigmatic. In six years of research we have talked to people at Marshall and elsewhere in NASA, and have heard interpretations of the Center that are often strikingly contradictory. Some outsiders criticize Marshall as having a closed culture, impervious to penetration from the outside; most Marshall veterans see their Center as open, seeking interaction with other groups at every opportunity. Outsiders sometimes describe Marshall's

management as authoritarian; insiders typically see top officials as responsive to ideas from lower-ranking experts. Some see Marshall's history as a prosaic tale of bureaucratic growth and inertia, common to NASA; others see a story of unique organizational culture. Howard McCurdy's recent book *Inside NASA* examines NASA's evolution and shows how early dynamism fell victim to increasingly complex limitations and tightening budgets. Not surprisingly many of his interviewees were Marshall veterans. Yet Marshall's team of German rocket experts and American engineers was unique in the annals of space pioneering, and the Center's first 30 years led to space science and engineering achievements of unparalleled breadth.

Marshall has been at the forefront of the frontier of space, but it has also been a center of controversy. In its first three decades, NASA had three major crises: the Apollo fire in 1967, the *Challenger* disaster in 1986, and a crisis of confidence in the late 1980s in which initial shortcomings of the Hubble Space Telescope and questions about Space Station planning and funding focused national attention on NASA's uncertain future. Marshall was at the margins of the Apollo fire investigation, but at the center of the crises of the 1980s.

One of our major goals then has been to show the complexity of Marshall's history and culture. Moreover, the story of the Center sheds light on the contemporary history of the government-industrial complex, the management of technological endeavors, and the evolving networks of engineers and researchers in "big science." In addition, anyone who hopes to understand NASA's future must come to terms with Marshall's past, for the Center has been a microcosm of the Agency. The major themes of NASA's development over its first 30 years extend through Marshall's history.

The Federal Government assumed responsibility to fund technological research and development tasks in the years after World War II, and by the late 1950s it became apparent that a new federal agency, the National Aeronautics and Space Administration, would be one of the major recipients of federal money. President Kennedy made that commitment a national quest when he directed the new agency to land a man on the Moon by the end of the decade. With that mission NASA emerged as one of the most visible federal agencies. Marshall was one of the three major NASA installations involved in Apollo, and the Center was the largest recipient of NASA funds and had the largest workforce in the early 1960s. Marshall's expertise in rocketry made fulfillment of Kennedy's challenge possible.

The aftermath of Apollo ushered in a new era for Marshall and for NASA. Marshall was the first NASA installation to experience the impact of tightening budgets, cutbacks, and readjusted schedules as Apollo wound down. As one of NASA's two largest field Centers and the one with the most entrenched tradition of in-house production, Marshall was at the center of NASA's shift from the arsenal organization, capable of internal development of hardware to contractor production. Marshall and its surrounding community learned that federal money does not come unencumbered, and the government used the Center to pressure Alabama to reform its pattern of racial segregation. When the government determined that NASA's mission would broaden to include international participation in its programs, Marshall was again in the forefront, managing development of Spacelab with the European Space Agency and incorporating multinational participation in Space Station and other programs. Post-Apollo cutbacks forced the Center to compete with other NASA Centers for business. NASA fostered competition, convinced it promoted creativity, and certain that the benefits of resourcefulness outweighed the costs of Center rivalry. Marshall proved an able competitor, and in the late 1960s began extensive diversification that restructured the Center. Marshall now began to supplement its work on NASA's major human space flight programs with work in space science, which involved both piloted and robotic space technology. The Center worked on technology supporting all types of missions, and in the process developed a scientific and technological diversity unmatched at other Centers.

Marshall in 1990 was a very different institution than it had been in the 1960s. The changes reflected the vision, will, and talent of the people who have worked there through its first three decades, and the external environment in which they worked. No longer merely a propulsion Center, it developed a vast capacity to develop new generations of space vehicles and to lead research investigations in emerging fields of space science. For 30 years the Marshall Space Flight Center indeed remained at the center of NASA's quest to explore space.

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1 Rip Bulkeley, *The Sputniks Crisis and Early United States Space Policy: A Critique of the Historiography of Space* (Bloomington: Indiana University Press, 1991), pp. 204–205.